



# ICAO ENGINE nvPM EMISSIONS DATA SHEET

## SUBSONIC ENGINES

ENGINE IDENTIFICATION: Trent 1000-G3 BYPASS RATIO (-): 9.1  
UNIQUE ID NUMBER: 01P19RR109 PRESSURE RATIO  $\pi_{co}$  (-): 44.7  
COMBUSTOR: Phase5 Tiled  
ENGINE TYPE: TF RATED OUTPUT  $F_{oo}$  (kN): 323.7

### REGULATORY DATA

| CHARACTERISTIC VALUES:             | $LTO_{mass}/F_{oo}$<br>(mg/kN) | $LTO_{num}/F_{oo}$<br>(particles/kN) | NVPM MASS CONCENTRATION<br>( $\mu\text{g}/\text{m}^3$ ) |
|------------------------------------|--------------------------------|--------------------------------------|---|
| $LTO/F_{oo}$ AND MAX $nvPM_{mass}$ | 199.9                          | 1.74E+15                             | 3410  |
| AS % OF CAEP/10 LIMIT              | -                              | -                                    | 86.6  |
| AS % OF CAEP/11 LIMIT (InP)        | 57.5                           | 41.7                                 |   |
| AS % OF CAEP/11 LIMIT (NT)         | 93.4                           | 62.6                                 |   |

### MEASURED DATA

| MODE  | POWER<br>SETTING<br>(% $F_{oo}$ ) | TIME<br>minutes | FUEL FLOW<br>kg/s | EMISSIONS INDICES*     |                              | NVPM MASS CONCENTRATION<br>PEAK $nvPM_{mass}$<br>( $\mu\text{g}/\text{m}^3$ ) |
|---|-----------------------------------|-----------------|-------------------|------------------------|------------------------------|---|
|   |                                   |                 |                   | $EI_{mass}$<br>(mg/kg) | $EI_{num}$<br>(particles/kg) |   |
| TAKE-OFF  | 100                               | 0.7             | 2.449             | 48.7                   | 1.37E+14                     |   |
| CLIMB OUT   | 85                                | 2.2             | 2.005             | 84.4                   | 2.92E+14                     |   |
| APPROACH  | 30                                | 4.0             | 0.667             | 73.6                   | 8.55E+14                     |   |
| IDLE  | 7                                 | 26.0            | 0.250             | 19.0                   | 4.54E+14                     |   |
| LTO TOTAL (kg, mg, number of particles)   |                                   |                 | 918               | 46547                  | 4.05E+17                     | -   |
| NUMBER OF ENGINES   |                                   |                 |                   | 1                      | 1                            | 1   |
| NUMBER OF TESTS   |                                   |                 |                   | 3                      | 3                            | 3   |
| AVERAGE $LTO/F_{oo}$ VALUES (mg/kN, particles/kN)                                   |                                   |                 |                   | 143.8                  | 1.25E+15                     | -   |
| MAX EI VALUES (mg/kg, particles/kg) AND MAX MASS CONC. ( $\mu\text{g}/\text{m}^3$ ) |                                   |                 |                   | 152.4                  | 9.67E+14                     | 2649  |

\* Emissions Indices are corrected for thermophoretic loss and fuel hydrogen content

### DATA FOR EMISSIONS INVENTORIES (ESTIMATIONS FOR ENGINE EXIT PLANE VALUES)

| MODE      | POWER<br>SETTING<br>(% $F_{oo}$ ) | CORRECTED EMISSIONS INDICES |                                 |
|-----------|-----------------------------------|-----------------------------|---------------------------------|
|           |                                   | $EI_{mass,SL}$<br>(mg/kg)   | $EI_{num,SL}$<br>(particles/kg) |
| TAKE-OFF  | 100                               | 52.2                        | 1.86E+14                        |
| CLIMB OUT | 85                                | 91.3                        | 4.25E+14                        |
| APPROACH  | 30                                | 85.1                        | 1.92E+15                        |
| IDLE      | 7                                 | 22.9                        | 9.02E+14                        |

### AMBIENT CONDITIONS

|                                | From   | To     | FUEL                          |       |
|--------------------------------|--------|--------|-------------------------------|-------|
| BAROMETER (kPa)                | 100.8  | 101.6  | HEAT OF COMBUSTION (MJ/kg)    | 43.34 |
| TEMPERATURE (K)                | 287.0  | 292.6  | HYDROGEN CONTENT (%mass)      | 13.97 |
| HUMIDITY (kg water/kg dry air) | 0.0080 | 0.0090 | AROMATICS CONTENT (%vol)      | 15.9  |
|                                |        |        | NAPHTHALENE CONTENT (%vol)    | 0.11  |
|                                |        |        | SULPHUR CONTENT (ppm by mass) | 300   |

MANUFACTURER: Rolls-Royce plc  
TEST ORGANIZATION: Rolls-Royce plc  
TEST LOCATION: Derby  
TEST DATES: 04/10/2018

### REMARKS

1. Certification Report EDNS01000740804

**\*\* DATA SUPERSEDED \*\***

**SEE FOLLOWING UID FOR REVISED DATA:**

**02P23RR129**